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Consequences of Agricultural Technology Transfer on Weaker Sections in India

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Prelude

Before discussing the consequences of agricultural technology transfer on the weaker sections in India, the paper begin with basic conceptual clarities about "who constitute weaker sections or more specifically rural poor in India" and "what are the agricultural technologies transferred, which are affecting either positively or otherwise to these rural poor". Very often rural poor and weaker sections in the rural India are used, as synonyms but there are basic differences among them. Rural poor is a broader term include all social classes that are struggling for their livelihood, while weaker sections indicate (but not used exclusively) towards social groups that belongs to a particular category such as caste, economic class, etc. Looking at the social stratification in India, we shall be using both the terms simultaneously. Further classification of the rural poor and weaker sections is discussed in section one of this paper.

Agriculture in rural India provides direct livelihood to nearly 70 % of the population, either as cultivator or agricultural labourers. Since middle of the last century agriculture was managed on the traditional knowledge system existed and carried over by the farming community through their generations. After independence India faced an acute food shortage due to huge gap between the production level and demand for major foodgrain crops. There were two options available for increasing production of the food grains; first by increasing area under the crops and secondly, by increasing productivity of the major food grain crops. After assessing, the scope for both the strategies it was decided to increase the productivity of the agriculture through introduction of new High Yielding Varieties and through bringing matching change in the package of practices. Since then there has been continuous change in the production techniques of the major crops. This paper looks at the agricultural technologies, which were transferred during green revolution, post green revolution and post economic reform period for assessing their impacts on the rural poor.

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The text in the paper is divided in to four sections; first section discusses the agrarian context for setting target groups on which impact of the agricultural technology transfer is analyzed. The second section analyses the technological changes that have taken place in the decades of 1960s, in post green revolution and in the post economic reform period. The quantitative increase in the agricultural production is analyzed in section two. The third section analyzes the impacts of agriculture technology transfer on qualitative aspects such as agrarian structures, livelihood, sharing of benefits, etc., of rural poor and weaker sections. Fourth section summarizes the lessons, which are learnt from the agricultural technology transfer and suggests the ways for future.

Part I

To locate weaker sections in the agrarian context, let us have a look on the agrarian categories in India. The criteria for agrarian categorization are debated and there emerges two schools of thoughts for differentiating agrarian community; first is based on the agrarian history and second on the economic classes. According to the agrarian history and pattern of land ownership in India, we may have five different classes of the rural community such as landlords, rich farmers, middle peasants, poor peasants and landless agricultural labourers (Oommen, 1989). This categorization is based on the traditional agrarian relations and very often it is difficult to identify the categories. While agrarian categories, which are decided on the acreage of the land holding are widely used. In this paper we shall be assessing the impact of the agricultural technology transfer on the six agrarian classes according to their land holding (Table 1 and Table 2), which are clubbed in to four according to their capability to absorb the agricultural technology transfer. These agrarian classes are described here.

1. Large farmers

This group of farmers is traditionally landlords who own but do not cultivate land. In economic terms any individual who owns 10 hectares and above land comes in this category. According to the 1991 census 1.6 % of the total land holding in India are in this category and this small category controls nearly 17.4 % of the land. Further, large farmers in the scheduled caste communities are less than 1 % and control nearly 2.2 % of the SCs owned land (Table 2). This suggests that Social Group, which comprises of Upper Castes and Backward Castes, controls land in India.

Table 1. Distribution of operational holding and area operated in 1985-6 and 1990-1 all social groups

Category of holding	No. of operational holdings (millions)			Area operated (million/ha.)	
	Units	1985-6	1990-1	1985-6	1990-1
Marginal (below 1 ha.)	No	56.15	62.11	22.04	24.62
	%	57.80	59.00	13.40	14.90
Small (1-2 ha.)	No	17.92	19.96	25.71	28.70
	%	18.50	19.00	15.60	17.30
Semi-Medium (2-4 ha.)	No	13.25	13.91	36.67	38.25
	%	13.60	13.20	22.30	23.20
Medium (4-10 ha.)	No	7.92	7.63	47.14	45.05
	%	8.10	7.20	28.60	27.20
Large (10 ha. & above)	No	1.92	1.67	33.00	28.90
	%	2.00	1.60	20.10	17.40
Total	No	97.16	105.26	164.56	165.62
	%	100.0	100.00	100.00	100.00

Source; Indian Agriculture in Brief, 1995

Table 2. Distribution of holdings by various social groups by categories in 1985-6 and 1990-1

Categories	No. (millions) and percentage of holdings by social categories						
	Units	Scheduled castes		Scheduled tribes		Others	
		1985-6	1990-1	1985-6	1990-1	1985-6	1990-1
Marginal (below 1 ha.)	No.	8.51	9.44	3.16	3.66	44.48	49.00
	%	70.60	71.80	41.30	42.90	57.40	58.60
Small (1-2 ha.)	No.	1.92	2.11	1.80	2.06	14.20	15.79
	%	16.00	16.00	23.50	24.10	18.30	18.90
Semi-Medium (2-4 ha.)	No.	1.07	1.09	1.55	1.68	10.64	11.15
	%	8.90	8.30	20.30	19.70	13.80	13.30
Medium (4-10 ha.)	No.	0.45	0.43	0.94	0.95	6.53	6.25
	%	3.80	3.80	12.20	11.10	8.40	7.50
Large (10 ha. & above)	No.	0.09	0.80	0.21	0.19	1.62	1.40
	%	0.70	0.60	2.70	2.20	2.10	1.70
All categories	No.	12.04	13.15	7.65	8.54	77.47	83.59
	%	100.00	100.00	100.00	100.00	100.00	100.00

Source; Indian Agriculture in Brief, 1995

Large farmers either live in the same village where they own land or may be absentee owners. Their life style is feudal, they do not work and their activities are organized around traditional types of pleasure seeking. Generally speaking this is a shrinking category due to the introduction of agrarian legislations relating to abolition of absentee ownership, intermediaries, ceiling on land holdings and other reforms. Most of the large farmers are drawn from the traditionally privileged castes such as Brahmins and Rajputs.

In post economic reforms period in India, market economy slowly but steadily penetrating in to the farm sector. The large farmers that also include state, own a large chunk of land; they are giving a way to the Corporate farming in India. Apprehensions are expressed that corporate form of cultivation will displace small and marginal farmers as well as landless agricultural labour from agriculture, as most of the farm operations will be mechanized.

2. Semi medium and medium farmers

These two categories of the farmers generally own land but do not cultivate, they work as farm managers and get the work done by labourers. They look upon agriculture as a business and thereby they produce for market and for profit. This category is the product of green revolution and continuing to remain as beneficiaries of the agriculture technology transfer. They constitute about 20 % of the farmers and generally come from land owning peasant castes such as Jats, Ahirs, Reddis, Kammas, Naires, Patidars, etc. Among the SCs, percentage of semi-medium and medium farmers do not exceed 5, which suggests that changes in the farm sector especially transfer of technology is benefiting only small percentage of the farming community, which is constituted by the landowning castes. These two categories are also enjoying as recipient for the state farm subsidies.

Among these middle levels of farmers, there is another category of the agriculturist, which is not primarily based on the size of their land holding, but this is based on the traditional joint family system. The land of father is not subdivided among his sons, rather his sons hold the land at household level and cultivate jointly on it. Since they have many members in the household, they participate in the agricultural operations directly and hire labourers only for certain operations at certain point of time. Most of such families are uneducated but capable of making rational decisions provided they are convinced with the advantages of the new measures and of course they can afford it.

3. Small and marginal farmers;

Those persons who own less than 2 ha of land mainly constitute this category. Majority (approximately 80%) of the Indian farmers belong to this category (Table 1) and they are aware of economic non-viability of their land holdings but still cultivating, since they have no other alternate livelihood. Among the SCs social class, the percentage of small and marginal

farmers is greater (Table 2).

Often their landholdings are so small that they cannot make both ends meet exclusively through the income derived from it and therefore are also partly laborers. They may also work as sharecroppers or tenants of various types. These peasants find it difficult to secure the benefits available through state either because of their land holdings are uneconomical or because they lack social skills to manipulate the administrators. This category is drawn from almost all caste groups, although most of them may be from backward and scheduled caste.

4. Landless agricultural laborers

This category do not own land, if they did it is not more than abadi land on which their huts are built. Their sole source of income is their labour and hence they are dependent for their livelihood on others; especially on the first two categories of the farmers whose land holding are considerably large. Majority of these labourers belong to Scheduled Caste who occupy the lowest ritual status in the traditional caste hierarchy of India.

From the above discussion, it emerges that traditional society in rural India may be put under four broad categories; first two may be said as well to do categories while later two qualify to be labeled as weaker sections. Theoretically, our emphasis should be to analyze the impacts of agricultural technology transfer on the lower rung in the chain of the agrarian hierarchy that is landless agricultural labourers but evidences suggests that there are drastic changes in the traditional agrarian relations (Tyagi *et.al.* 2002, Chandy and Tyagi 1998). Labour market has developed in the areas, which have contributed maximum to the foodgrain production in India. These labour markets help the landless labourers in rural areas to shift their occupation between farm and non-farm activities according to the availability of work. Therefore, it would be difficult to assess the impact of agricultural technology transfer on the socio-economic activities of landless labourers. On the other hand marginal and small farmers are sticking to the agriculture for their livelihood either as cultivators or agricultural labourers. Thus, weaker sections for this paper will include marginal and small farmers along with landless agricultural labourers.

Part II

This section attempts to analyze the technological changes and their impacts on the Indian agriculture during last fifty years. India remains one of the few countries, which has witnessed significant changes in the agricultural technologies and equally spectacular changes in the life and living of rural population. Technological advancement in the farm sector of certain areas such as Punjab, Western Uttar Pradesh, Haryana, etc., brought widespread changes in society and economy of these states. The agricultural technologies that led to significant consequences are biological, chemical and mechanical in nature.

Though increase in farm productivity has always been sought in India's development programmes through diffusion of biological, chemical and mechanical innovations, spectacular results in certain states were obtained only as a result of green revolution in the decade of 1960s to 1980s. The success of green revolution is highly dependent on the use of high yielding dwarf varieties, chemical fertilizers, and pesticides, along with assured irrigation. This led to the rapid expansion of the irrigation facilities through tube wells, canals and other means.

Green revolution proved a turning point in the modernization of Indian agriculture. It boosted intensive use of land resources, enhanced utilization of available water resources, changed cropping pattern, increased input, etc. The contribution of technological invasion in Indian agricultural can also be seen in diversification of the economy to non-agricultural areas. With increase in the farm productivity, there has been a corresponding spurt in activities connected with secondary and tertiary sectors of the economy. Over the year dependency of population on agriculture has decreased from 75 to 68 %. There is continuously shift of the people from agriculture to non-agriculture areas.

Indian's food grain production increased four fold in a span of fifty years, but this increase could remain limited to the few crops and few areas (Table 3 and 4). The unique example of the wheat in Punjab, Haryana and Uttar Pradesh could not be universalized. The national average for wheat productivity increased from 668 kilograms per ha in 1950-51 to 2,708 kilograms per ha in 2000-2001, which is an increase of 400 %. On the other hand productivity for pulses could register an increase of 23 % only over the period of 50 years, which may not be considered as significant change from any perspectives (Table 3). Similarly, agricultural technology transfer could not make significant change in the production and productivity of oilseeds and course grains. Here it is significant to be considered that oilseeds, pulses, course grains and even 60 % under rice is rainfed, even then growth performance of oilseeds and pulses is far below the satisfaction and it is waiting for technological breakthrough as in case of wheat.

Another phenomenon began from green revolution and followed thereafter till now is regionalization of the agricultural development to the certain states, which are performing better. For example in year 2000-2001, 43.79 % of foodgrain production in India contributed by Uttar Pradesh, Punjab and Madhya Pradesh, while in the same year Uttar Pradesh, Punjab and Haryana jointed contributed 68.19 % of the total wheat production (Table 4). This encouraging performance of some states can be attributed to the spread of new technology pertaining to the crop cultivation. These evidences suggest that regional imbalance caused by green revolution in the decades of 1970s and 1980s has been further widened in the decade of 1990s. The consequences of the regional imbalance and other outcome of the agricultural technology transfer are discussed in the next section.

Table 3. Production (million tones) and productivity (kilograms/ha) of major crops and oilseeds in India since 1950-2000

Crops	Production/ Productivity	Time Series					
		1950-51	1960-61	1970-71	1980-81	1990-91	2000-01
Rice	Production	20.58	34.58	42.22	53.63	74.29	87.70
	Productivity	668	1013	1123	1336	1740	1961
Wheat	Production	6.46	11.00	23.83	36.31	55.14	69.68
	Productivity	663	851	1307	1630	2281	2708
Course cereals	Production	15.38	23.74	30.55	29.02	32.70	31.08
	Productivity	408	528	665	695	900	1027
Pulses	Production	8.41	12.70	11.82	10.63	14.26	11.08
	Productivity	441	539	524	473	578	544
Total food grains	Production	50.83	82.02	108.42	129.59	176.39	199.54
	Productivity	522	710	872	1023	1380	1648
Oilseeds	Production	5.16	6.98	9.63	9.37	18.61	18.44
	Productivity	481	507	579	532	771	810

Table 4. Leading states in production of food crops and oilseeds crops 1999-2000

Crops	States	Production	% share to all India	Cumulative % of production
Rice	West Bengal	13.95	15.59	15.59
	Uttar Pradesh	12.91	14.43	30.02
	Andhra Pradesh	10.49	11.72	41.74
Wheat	Uttar Pradesh	25.98	34.38	34.38
	Punjab	15.91	21.05	55.43
	Haryana	9.64	12.76	68.19
Total coarse cereals	Maharashtra	6.45	21.16	21.16
	Karnataka	5.25	17.22	38.39
	Uttar Pradesh	3.75	12.30	50.69
Total pulses	Madhya Pradesh	3.80	28.46	28.46
	Uttar Pradesh	2.60	19.48	47.94
	Maharashtra	2.19	16.40	64.34
Total foodgrains	Uttar Pradesh	45.24	21.66	21.66
	Punjab	25.20	12.06	33.72
	Madhya Pradesh	21.02	10.06	43.79
Total oilseeds	Madhya Pradesh	5.59	26.78	26.78
	Rajasthan	3.58	17.15	43.94
	Maharashtra	2.64	12.65	56.59

Part III

The new technology for its quick spread was instrumental in bringing about significant changes in whole development policy and strategy of India. From very beginning India's development policy was influenced by the ideals of rapid economic growth with social justice. Community Development programme was launched in 1952 to bring about all round development of rural communities. However in view of the increasing food shortages and mounting concern for immediate gain in production led to the shift in developmental priorities. Consequently agriculture was given top priority in the rural development and efforts were concentrated since early sixties in selected areas with high production potentials. Such a strategy was translated in to action through a series of programmes such IADP (Intensive Agricultural District Programme), IAAP (Intensive agricultural Areas Programme), etc. The change in the strategy is accompanied by drastic change in the developmental organization, agricultural administration, research and extension system, credit and input supply infra-structure, storage and marketing facilities, transport and communication network, etc (Kalcon, 1970). This technological upsurge has given rise to three types of problems; extension of green revolution to rainfed areas, second creating additional facilities for storage and problem of equity, welfare and employment.

The requirement of controlled and assured irrigation has also acted as constraint in restricting the effects of green revolution to a limited area. The land with assured irrigation facilities and higher fertility levels offered greatest promise to raise agricultural production through seed-fertilizer technology. The bulk of India's food grains production as also marketable surplus come from irrigated agriculture. The choice logically fell in favour of northern Indian states such as Punjab, Haryana and Western Uttar Pradesh, forming continuous irrigated tract, which is known as the main seat of green revolution and is providing 90 % of the wheat and 75 % of the rice for public distribution system (Bhatia, 1988). The rainfed areas comprising 70 % of the land as against 30 % of irrigated areas remain outside the fold of green revolution.

Yet another constraint in the spread of green revolution was the concentration of development efforts among farmers in such areas where favorable infrastructure facilities like credit institutions already existed. The allocation of inputs was also determined on the basis of resource endowment, past performance and eligibility criteria. The provision of scarce modern inputs mainly for those who can make their optimum use rather than thinly spreading them provides a rationale for this approach. This approach contributed in restricting the benefits of green revolution to certain areas and groups.

Since beginning of green revolution, the new technologies in agriculture are increasing the dependence of the farmers on external sources for supply of the agro-inputs. Farmers are increasingly becoming dependent on the market for new seeds, chemical fertilizers, plant protection measures, farm machines, etc. Agricultural has become increasingly capital intensive since dependence on purchased inputs has substantially increased. This has also implied increased dependence of agriculture on external and international markets particularly for chemical fertilizers, pesticides and oil for running irrigations pump sets, tractors and other machinery (Dasgupta, 1983). With interventions of the transnational corporations in the agro-input supply business such as hybrid seeds, etc., have brought the farmers on the cross roads and they are not able to decide wheather tp remain abstain from the technology or adopt it. This process has gradually drawn marginal and small farmers away from the benefits of the technology transfer. Since late 1990s, cases of suicide by the farmers in green revolution areas vindicate the hypothesis that agriculture Technology Transfer has benefited the well-off farmers in well-off areas. Increasingly dependence of the farmers on the market is proving detrimental to the marginal and small farmers, who can not afford to buy costly seeds and fertilizers or at-all if they buy, it bring them in the trap of financial crisis, which compel the farmers to take steps like suicide.

It is evident from the discussion above that introduction of new agricultural technologies have resulted in further increase in the disparities. It is mainly because of weakening position of the small and poor farmers that there is gradual reinforcement of the powers to the rural rich. The distribution of assets, particularly that of landed one, is highly skewed. The inheritance laws and resultant fragmentation of holding is further worsening the condition of poor farmers. In contrast, the power of the larger farmers by adopting new technology has further strengthened and their profits and assets have increased substantially. New acquired farm assets such as tractors, tube wells are getting concentrated in to the hands of rich farmers resulting in to a new kind of patron-client relationship between the rich and the poor farmers. New economic policies of the Indian Government initiated in the beginning 1990s have further alienated the small and poor farmers from the benefits of the new technologies in agriculture.

The argument put forward in the decade of 70s of the last century that new technology has generated additional work opportunities in the farm sector do not hold true. The multiple cropping and intensive agricultural made it necessary to mechanize certain operations which in turn displaced both human and animal power to a certain degree. Though there are some work opportunities generated by new technology in the tasks such as fertilizer application, weeding, interculture operation, harvesting and post harvest operations but it does not compensate for displacement of the landless agricultural labourers caused by mechanization of the farm operations.

Greater consequences of the new technologies are observed on the traditional agrarian relations, institutional frameworks and agrarian structures, as a result of undue emphasis placed on the technological solution to the food problem and due to negligence of the institutional issues involved in it. The new technology was tilted in favour of areas and groups endowed with better quality lands, assured irrigation, facilities, more developed infrastructure and better resources. It was assumed that in due course, benefits of the new technology would percolate down to the poorer regions and groups. Conversely, the increase in the food output and employment as a result of new technology will bring additional income to all sections of the population including poor and landless. The rationale underlying the strategy was that the scarce resources and modern input should reach first to those areas and people who are likely to make their optimum use. This selective approach is opposite to the objectives of community development programme, which aimed to benefit the whole community.

The prospects of double cropping and increased chances of additional benefits led a steep rise in the rents, resumption of land for self-cultivation, eviction of tenants and dispensing with hired labour. The landlords prefer contract or casual labour. The crop sharing arrangements have also undergone change; the landowner now do not agree to give land on crop share basis since the same amount of grain given to the share cropper now fetches much higher amount of money. Payment is hence made now in cash rather than in kind. These changes have affected the landless agricultural labourers and marginal and small farmers who were engaged in the sharecropping arrangements.

Further, the concentration of efforts and rapid increase in productivity mainly in irrigated and well-endowed areas and regions is responsible for two inter-related consequences. First, it has accelerated the process of economic polarization, and secondly, it has promoted social tensions and antagonism between different agrarian classes. Widespread violence in the state of Punjab for more than a decade after the region was covered by green revolution is a live example of the social tension. The Punjab, which was more or less an average state at the time of independence, emerged as most prosperous state after green revolution, thereby causing regional imbalance. The villages in Punjab are well equipped with basic infrastructure facilities such as brick built houses, developed roads, electricity, schools and hospitals, etc and present altogether a different picture. Rural Punjab presents a striking contrast to the poverty stricken, dark counterpart elsewhere with muddy roads and mud walled thatched roofed houses and few social amenities. One can witness similar contrast between villages and groups with in a region, which also manifest great disparities in productivity and incomes depending upon their access to productive resources and new technology. The growing economic disparities combined with increasing un-employment and exploitation of tenants, sharecroppers and landless labourers tended to increase social tensions among different

classes. Bihar, which lies in the eastern part of India, is facing social tension between two communities namely Bhumihars (land owning classes) and landless labourers mainly Scheduled Castes, which were share croppers on the land of Bhumihars once upon a time and now asking for their rights on the land as well as other common properties in the village domain. Yet another source of mounting tension is the increasing influx of migrant from poorer regions to the green revolution areas in search of livelihood. It is in these in built contradictions of the new technology, it is increasingly being feared that areas of green revolution may turn into the grounds for bloodshed due to social tensions.

It is evident from the discussion on the consequences of the agricultural technology transfer that the new technology, with its dependence on the modern inputs and progressive farmers for its success, is able to provide enough food but not employment to the poor. Evidently distribution aspect seems to be neglected and not working at all. The costly nature of inputs like tractors and tube-wells continues to make the new technologies biased against small farmers. The insufficient institutional credit as compared to the total cost of inputs, inaccessibility to the credit institutions, complex bureaucratic formalities, rigid lending procedure, and similar factors making it almost impossible for poor villagers to get financial support. The obvious inference one can draw in such situations is that the gains of new technologies are reaped more by already prosperous regions and groups thereby accentuating further regional imbalance and economic inequalities between the rich and the poor.

Part IV

If the Agricultural Technology Transfer is allowed to go on as it is today, majority of the small and marginal farmers along with landless labourers shall be displaced from the agriculture and there is likely to be migration by masses towards cities. If slogans such as the transformation of rural life, or the achievement of growth with social justice are to be translated into reality, then new technology should be made affordable to the small and marginal farmers. In the post economic reform period there are clear evidences that state is gradually reducing subsidies from agriculture, so we cannot expect the state to subsidies the technologies. In this situation answer has to be searched by the farming community themselves with in their own resources. These conditions necessitate for changes in social organization of the agrarian relations. The marginal and small farmers shall have to organize themselves in to the groups either as cooperatives or any other form of interest groups, which could take up farming on economy of scales.

There are striking examples within Indian state of the economic benefits that can accrue to the small cultivators by collective actions in the groups. The Bhartiya Agro Industries Foundation in Pune, Maharashtra has sponsored a whole set of co-operative activities like lift

irrigation, dairying, poultry, and joint farming based on the concept of uplifting the rural poor through the latest agricultural and animal husbandry technique. The work of the Kaira District Cooperative Milk Producers' Union, Anand, is too well known and need no description. The Tudiyalur Cooperative Society has been providing total service to about 8,000 cultivators in Coimbatore district of Tamilnadu. The Syndicate Agriculture Foundation Manipal, Mahatma Gandhi Lift Irrigation Co-operative Society Gaddipalli, Kerala Development Society, etc., are few more example of the cooperative initiatives.

The future of farming lies in the group initiatives and there is need to universalize the isolated success stories cited in the previous paragraph through multiplications and replications. At the village level this can be done by the combination between those who possess the technical knowledge and those who are devoted to social service and together identify and prioritise the needs of the villagers. If the needs are correctly identified, prioritised and properly attended, it will act as catalyst for the marginal and small farmers. Let me end up with a quotation of Dr M. S. Swaminathan.

"India's political freedom depends on rapid economic growth and this in turn depends on its performance in agriculture. The future of India's agriculture in turn depends on the success with which the educated can help the small and illiterate farmers to take the many small steps, which alone can lead to a great agriculture. Science can only show the way; it is for us the educated and privileged class, to provide the will".

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